SPECIFICATION SECTION 16710

MULTI-MEDIA SYSTEMS

PART 1 - GENERAL

1.00 RELATED DOCUMENTS

A. Washington State Information Services Board-Information Technology Policy-Submission Requirements-Computing and Telecommunications Architecture Standards-Building Wiring. http://isb.wa.gov/policies/portfolio/701S.doc

B. American National Standard ANSI/TIA/EIA Telecommunications Building Wiring Standards.

C. Drawings and general provisions of the Contract, including General and Supplemental Conditions and other Division 1 Specification Sections, apply to this Section.

D. Refer to the following sections for additional requirements:

1. Specification Section 07841 – Through-Penetration Fire Stop Systems.
2. Specification Section 16111 – Telephone/Data Raceway System.
3. Specification Section 16130 – Boxes (Sizes, Styles and Types).
4. Specification Section 16630 – Rescue Assistance Telephone System.
5. Specification Section 16650 – Electrical for Telephone/Data Systems.
6. Specification Section 16651 – APPENDIX-A (Approved Products).
7. Specification Section 16651 – APPENDIX-B (Glossary of Terms).
8. Specification Section 16651 – APPENDIX-C (EWU Building Abbreviations).
9. Specification Section 16651 – APPENDIX-D (EWU Station Cable Record).
10. Specification Section 16651 – APPENDIX-E (EWU Telecom Typical Rack Layout For Equipment).
11. Specification Section 16651 – APPENDIX-F (EWU Telecom Typical Rack Layout For Data Patch Panels).

1.01 SCOPE

A. It is the intent of these specifications to provide complete multimedia systems for the (Building Name) Classrooms. The multimedia system are composed of the following integrated subsystems: visual presentation system; televideo system; sound reinforcement system; assisted listening system; and the remote control system. This equipment is to be furnished under the basic bid. Owner shall supply a list of the (Building Name) classrooms with an equipment list for each room.

1. The video presentation systems shall include video projectors, projection control switchers, projection matrix switchers, distribution amplifiers, video cassette player/recorder, 35mm slide converter (to video for projection), DVD/laser disc player, digital presenter, electronic whiteboard, outlets, switches, relays, wire, cable, and adapters as required for complete operable systems which perform the functions specified herein and on the drawings. Provide a complete operational projection system for the indicated room.
2. The televideo system shall consist of a rack mounted videoconferencing unit, wireless microphones, PTZ cameras, plasma screen monitors, wire, cable, and adapters as required for complete operable systems which perform the functions specified herein and on the drawings. Provide a complete operational televideo system for the indicated rooms.
3. The sound reinforcement systems shall consist of a wireless microphone system with 2 lavaliere microphones, an automatic microphone mixer, power amplifier, equalizer, speakers, wire, cable, all mounting hardware, and any other ancillary devices or equipment required for a complete system which operates as described herein and on the drawings.
4. The assisted listening systems shall consist of radio frequency (RF) transmitters, slave emitters, antennae, RF headphone receivers, power supplies, wire, cable, all mounting hardware, and any other ancillary devices or equipment required for a complete system which operates as described herein and on the drawings.
5. Provide a complete remote control system for control of audio system, and multi-media presentation equipment as indicated on the drawings. Program the system in accordance with the Owner's requirements as indicated on the sequence of operation that will be provided by the Owner. The remote control system shall include tilt-screen control panels, cardframes, control modules, interface modules, power supplies, relays, contactors, connector strips, wire and cable as required for a complete operable system which performs the functions specified. Coordinate closely with supplier of the equipment to be controlled to assure that the controls will function as specified in conjunction with equipment actually furnished.

B. Quality Assurance

1. General

a. Contractors wishing to bid on the Multimedia System installation of the project must submit qualification documentation to the owner and engineer at least two weeks prior to date of bid opening.
b. Qualification of contractors will take place prior to the submission of bids. Bids from contractors not receiving prior qualification approval from the owner and owner’s engineer will not be accepted.
c. Notification of approval of contractor’s qualifications and experience will be given one week prior to opening of bids.

2. Qualifications of Experience

   a. The following criteria shall be used as a standard for judging installation qualification and project experience:

      1) Installing Contractor to have previously installed jobs of similar magnitude completed within the last five years. Similar magnitude includes; equal or larger venue size, system cost and complexity. Provide evidence of at least one such completed job for inspection by the owner and engineer. The information shall include project scope, system description, system cost, and owner and engineer references.
      2) The installing Contractor shall have at least five years experience with equipment and systems of the types specified.
      3) The installing Contractor shall maintain a fully staffed and equipped service facility, and shall be a franchised dealer and authorized service facility for the major brands specified.
      4) The installing Contractor shall be a Washington State, Spokane County licensed contractor, business and resident of five years minimum and maintain a service and installation staff of 10 full time installation and service technicians dispatched from the Contractors full time place of business located within a 30 mile radius of the Project site.
      5) To qualify as a bidder, the installation shall be made by a licensed and bonded contractor holding a valid Electrical Contractor's License and Administrator's Certificate as prescribed by the State of Washington. All work covered by this specification is to be performed by a holder of a current State of Washington Specialty Electrician for limited energy systems.
      6) The Installing Contractor shall have staffing and computer systems to produce acceptable quality shop drawings and project record documents. Schematic diagrams, speaker location, orientation, rigging, fabrication and layout details to b produced using AutoCAD 2000 or later.

3. Contractor Qualification Submittals

   a. Submittals for qualification shall include all of the following:

      1) A description of the installing contractor's fulfillment of qualifications and experience in all areas listed in the section above.

2) A brief company description outlining company history including how long the company has been in business, the number of personnel employed, etc.
3) Resumes of staff that will be involved in working on the project and their roles. Include education, training, experience, professional societies and notable contributions to the industry.
4) Representative project list. Include a project description, company personnel who worked on the project with their involvement, and a reference point of contact. Note whether the key personnel involved in these projects are still employed with the company.
5) Samples of project documentation. Include schematic diagrams, speaker orientation and rigging details, panel fabrication details, and any other applicable documentation.
6) Contractors who are approved by addenda will submit pricing as an Alternate.

C. Project Conditions

1. The contractor shall verify all conditions on the jobsite applicable to this work, and shall notify the Architect in writing of discrepancies, conflicts, or omissions promptly upon discovery.
2. The drawings diagrammatically show cables, conduit, wiring, and arrangements of equipment fitting the space available without interference. If conditions exist at the job site which make it impossible to install work as shown, recommend solutions and / or submit drawings to the Architect for approval, showing how the work may be installed.

D. Warranty

1. Installer shall warrant equipment to be free of defects in materials and workmanship for not less than one year after date of Substantial Completion. Defects occurring in labor or materials within one-year warranty shall be rectified by replacement or repair. Within the warranty period, provide answer to service calls and requests for information within a 24-hour period, and repair or replace any faulty item within a 72-hour period without charge, including parts and labor.
2. This warranty shall not void specific warranties issued by manufacturers for greater periods of time. Nor shall it void any rights guaranteed to the owner by law.
3. The Contractor shall provide Owner with exact beginning and ending dates of the warranty period, and shall Include the name of the person to call for service and telephone number. This information to be part of Project Record Drawings.

1.02 OPERATION - VIDEO PRESENTATION SYSTEM

A. The system shall accept broadcast-quality composite video input signals derived from in-room video cassette players, 35mm slide converters, televideo systems, DVD/laser disc players, and digital presenters.

B. The system shall accept VGA (video graphics array) or super VGA graphic data input signals derived from the in-room personal computer system or lap-top computer. Data-insertion jacks and audio jacks shall be provided to permit connection of various portable computers that may be supplied by the room users. Data signals shall be converted into RGB video with composite synchronization by means of computer-to-video interface adapters.

C. Switching shall be provided to select externally between the composite video input signal and the RGB video signal for data. A mode selector switch shall determine which input signal is routed to the video display equipment. The switching equipment shall include a scan doubler.

D. Switching of inputs shall be accomplished by a projection control switcher. Input and output options shall be selected by means of the remote control system utilizing an RS-232 control interface.

1.03 OPERATION – TELE-VIDEO SYSTEM

A. The system shall operate on both the H.323 and the H.320 protocols.

B. The system shall output to the video presentation system

C. The system will be controlled by the remote control system

1.04 OPERATION - SOUND REINFORCEMENT SYSTEM

A. The system shall accept audio input from an audio/video switcher and provide output to coaxial speakers located throughout the classrooms. The system shall receive an audio input from the wireless microphone transmitter/receiver pairs and provide automatic muting of the switched signal.

B. The system shall provide audio output to the assisted listening system.

1.05 OPERATION - ASSISTED LISTENING SYSTEM

A. The system shall receive an output from the sound reinforcement system and through the use of radio frequency transmitter/emitter pairs the signal is converted to a radio frequency signal. The receiver headphone will decode the signal to retrieve the original audio signal.

1.06 OPERATION REMOTE CONTROL SYSTEM:

A. The system shall provide programmable, full-featured electronic control of remote equipment by means of a microprocessor controller.

B. Control output devices shall be modular, plug-in type to permit the control system to be readily modified to accommodate future growth and/or changes in the equipment controlled.

C. One (1) tilt-screen control panels shall permit system operation from either of two (2) locations.

1. Operation shall be by touch-screen control "buttons" using touch panel icons.
2. System shall accommodate multiple nested touch panel "pages.
3. Page configurations shall be programmable.
4. Program shall become the property of the Owner.

D. The System shall be designed to allow for field programming and operator programming

1. Field programming at time of installation shall include:

a. Start-up menu page.
b. Set-up pages.
c. Protected set-up pages.
d. Functional pages.
e. External buttons.
f. RS 232 control of the video switcher.
g. RS-232 control of the projector(s) for initial setup and alignment.
h. IR control of the video cassette player to include: Play, Stop, Pause, Fast Forward, Rewind, Search and Closed Captioning.
i. IR control of the DVD/laser disc player to include: Play, Stop, Pause, Fast Forward, Rewind, Search, Closed Captioning and Chapter Selection.
j. Control of the 35mm slide converter to include: Forward, Reverse, Zoom and Focus through a communications bus.
k. Control of the overhead projection screen.
l. Volume control and muting.
m. Other functions as specified in the sequence of operation.

2. All user programming shall be accomplished using a menu-driven format to insure full system utilization with an absolute minimum of operator training.

3. Program format shall be user-friendly utilizing operation prompts with built-in programming error indications. It shall be impossible for the operator to damage or alter the software due to improper or accidental data entry.

E. All software and firmware shall utilize non-volatile memory

F. All equipment items shall be selected and installed to provide fully normal operation in the anticipated ambient temperature range of 55° to 100°F.

1.07 SUBSTITUTIONS

A. Throughout these specifications various materials, equipment, apparatus, etc., are specified by manufacturer, brand name, and type or catalog number. Such designations are intended to establish standards of desired performance, quality and construction as well as exact operating features required and shall be the basis of the bid. This specification is not intended to restrict competitive bidding.

B. Contractors wishing to bid on equipment other than that listed ('substitute' equipment) shall obtain prior approval of same. Approval of such items will be issued to all bidders by addendum. Requests for prior approval shall be submitted at least seven days prior to the bid date.

PART 2 - PRODUCTS

2.01 VISUAL PRESENTATION SYSTEMS

A. General

1. All equipment items shall be selected and installed to provide fully normal operation in the anticipated ambient temperature range of 55° to 100°F.

B. Video Projectors

1. Video Projector - Shall be an LCD projection unit. Picture orientation shall be switch selectable for proper display for either ceiling mount (unit upside down), rack mount (unit right side up) in either a front or rear screen projection configuration.

a. Light Output 3000 or more lumens.
b. LCD device.
c. Lenses F l.06 hybrid lenses, high definition, color corrected w/center & edge focus.
d. Scan Frequencies Horizontal 15-105 kHz autolock, Vertical 37-140 Hz autolock.
e. RGB Bandwidth > 75 mHz ±3 dB.
f. Max display resolution 1600 x 1200 pixels.
g. Horizontal linearity < +1-1.5% distortion in full horizontal frequency range.

h. Inputs• RGB analog BNC and D9 connectors• NTSC, PAL, SECAM BNC, looped through •S-Video 4-pin, looped through• Termination 750 switch for each looped through input.
i. Infrared Remote or Serial Communication Control.
j. Video projector shall be a Barco IQ G-350.

C. Video Projector Mounts

1. Overhead, ceiling mounted projectors shall be mounted on mounting brackets provided and installed by the general contractor. Coordinate with the general contractor and the owner for proper size, mounting, and orientation.

D. Projection Control Switcher and Trans-scaler

1. Projection control switchers shall provide RGB video outputs with synchronization, S-video outputs, composite video outputs, and audio outputs, selectable from any of the inputs. The switchers shall accept the following input modes:

a. Component RGB video with synchronization on green (RGsB).
b. Component RGB video with separate synchronization (RGBS).
c. Composite NTSC (National Television Standards Committee) video.
d. Composite PAL (Phase Alternate Line) video.
e. S-Video. (Y/C).
f. Audio.

2. The switches shall be capable of the following types of control for input selection:

a. Front panel buttons.
b. Digital RS-232 control.
c. Projector remote infrared control.

3. The switchers shall include the following features:

a. Composite video.
b. S-Video Termination.
c. Audio.
d. Termination 75 0 switch for each looped through input, Audio (2) RCA, 1-4V p-p, ± 3dB.
e. Output RGsB/RGBS (5) BNC connector, Composite video (1) BNC connector, S-video (1) 4-pin.
f. Communication, (1) 9-pin female SUBD connector.
g. Termination, 75 S2 switch for each looped through input
h. Rack mounting provisions, 3 rack units high, with 120 volt AC cord-and-plug power connection.

i. Projection control switcher shall be Autopatch 1YDM switcher, as manufactured by Autopatch Inc. of Cheney, Washington.
j. Trans-Scaler shall be an Analog Way TSC432.

E. 35MM Slide Film-To-Video Converter

1. 35mm Slide Film-to-Video Converter

a. Power 120 VAC, 60 Hz, 191 W.
b. Film Transport 2" x 2" 35 mm mounted slides.
c. Film Loading, Kodak 80/140 slide trays.
d. Slide Transport Forward and reverse by remote control.
e. Video Format NTSC compatible.
f. Image Pick-up element 1/3" progressive scan CCD.
g. Video Output 1.OV p-p, 75 0.
h. Resolution RGB: >600(H)x600(V) TV lines.
i. Video: >400(H)x350(V) TV lines.
j. Signal to Noise Ratio one source > 48dB
k. Connectors BNC (video and External Sync).
l. Optics Lens f=15mm-38mm, F1.9 zoom lens, remote control
m. Light Source 24v-6w lamp.
n. 35 mm slide film-to-video converter shall be a Elmo TRS-35XG.

F. Video Cassette Recorder/Player

1. The Video Cassette Recorder (VCR) shall be a 4 head-helical scanning, azimuth recording system conforming to S-VHS/VHS standards. The VCR shall have a minimum record time of 120 minutes and a minimum playback time of 120 minutes.
2. The VCR shall be NTSC compatible The VCR shall conform to the following specifications:

a. Video Input/Output Line 1.OVp-p, 75(, unbalanced.
b. Resolution: 400 lines, horizontal, S-VHS.
c. Video SNR: > 45dB.
d. Audio Input, 8dBv, 47k52, unbalanced, Microphone -60dB, 60052, unbalanced.
e. Audio Freq Response 20Hz to 20kHz.
f. Audio SNR: > 45dB.
g. The VCR shall be a Panasonic PV-PVS 4821.
h. Provide Middle Atlantic rack mount utility shelf U3.

G. DVD/Laser Disk Player

1. The disk player shall be capable of playing 12" and 8" laserdiscs, 5" CD audio discs, 5" CDV format discs, and 3" CD single audio discs. The player shall have a front fluoro-luminescent display with text display for titles, instructions and comments, Auto Start and Auto Repeat operations, a front panel shuttle dial for simplified playback control, user set forward and reverse scanning speed control, and disk scanning at 9x or 32x disc speed.
2. The disk player shall have a minimum of 425 lines of horizontal resolution and a minimum of 50dB, signal-to-noise ratio.
3. The disk player shall have an S-video output and an RS-232 input for computer system control.
4. The disk player shall be rack-mounted, have a separate remote control unit, and come complete with computer interface cable (minimum length of 15 feet). The disk player shall be Pioneer DVL 919. Provide Middle Atlantic rack mounting unit faceplate RSH-4A.

H. Document Projector:

1. Format VGA.
2. Image Pick-up element 1/3” 850,000 Pixels PS (progressive scan) CCD
3. Video Output C-video/S-video.
4. VGA Output 1,024 X 768(XGA) RGB color/ 800 X 600 (SVGA) RGB color/ 640 X 480 (VGA) RGB color.
5. Connector: Input – VGAx2, mouse x 1, Output – VGA x2, S-videox1, c-video x1 (RCA), RS-232C.
6. Document projector shall be a Samsung SDP-950DX.

I. Electronic Whiteboard

1. Interactive surface with pen tool to control applications or write notes.
2. Ability to record synchronized audio and data files, transform handwriting to text and write over moving video.
3. RGB video pass-through and USB connection.
4. Compatibility with Windows 98 or later and Mac OS 10.1 or later.
5. Electronic whiteboard will be Sympodium ID250 Interactive Pen Display.

J. VGA Computer-to-Video Interface Adapters

1. Provide an interface adapter to convert VGA or super VGA graphic data input from a computer to a standard component RGB video analog signal with synchronization. The output signal shall be compatible with the video projectors and video monitors that will be used as display equipment.
2. Each adapter shall include an input connector for VGA graphic data input and RGBHV output connectors with loop through output for local monitor, and horizontal centering.

a. The input connector shall be a 15-pin high-density connector male jack.
b. The output connectors shall be BNC connector jacks.

3. The adapters shall have a band width of 400 MHz (minimum) and a nominal impedance of 75 ohms.
4. Interface adapters shall be RGB 190F (VGA).

K. Wire and Cable

1. Cabinet wiring shall be #18 AWG (minimum) stranded copper with thermoplastic insulation and shall be compatible with disconnecting plugs. 120 volt wiring shall be #12.
2. Wire for circuits operating at 50 volts or greater shall be #12 AWG (minimum) .stranded copper with insulation rating of at least 90°C for both wet and dry locations, unless otherwise indicated or required. Nominal insulation voltage shall be at least 600 volts.
3. Cable for circuits operating at less than 50 volts shall be jacketed and suitable for Class 2 wiring. Conductors shall be #18 AWG stranded copper with insulation rating of at least 90°C for both wet and dry locations, unless otherwise indicated. Nominal insulation voltage shall be at least 300 volts.
4. RGBHV cable shall be high-resolution RGB bundled coaxial cable with five (5) bundled mini-coax cables in a single jacket, Extron #BNC-5 mini cable of the appropriate length, as manufactured by Extron Electronics of Santa Fe Springs, California. The part number for each specific cable shall be as follows:

a. Cable to each Video Projector: 26-260 (50 foot length).
b. Cable to each Interface Adapter 26-260 (100 foot length).

5. S-Video shall be high-resolution cable with male to male connectors, Extron #S-VHS series cable. The part number for each specific cable shall be as follows:

a. Custom Cable to each Projector 26-316-XX.

6. Composite video shall be RG-59/U, West Penn #834 with BNC connectors

L. Spare Parts

1. Provide the Owner with a recommended spare parts list for each system complete with pricing.

2.02 TELE-VIDEO SYSTEMS

A. General

1. All equipment items shall be selected and installed to provide fully normal operation in the anticipated ambient temperature range of 55° to 100°F.

B. Video-conferencing Unit

1. The videoconferencing unit shall support IP, ISDN and mixed calls. Supported network interfaces include ISDN BRI, ISDN PRI, Serial Network Interface (V.35/RS-530/RS-449 with RS-366 dialing)
2. Unit will have a maximum Data Rate IP or Serial: Up to 2Mbps and Maximum Data Rate ISDN: Up to 2Mbps.
3. Unit will have embedded multipoint capacity of 4 sites (ISDN/IP) and 1 telephone. Unit can view/send people and high resolution content simultaneously.
4. Inputs include 3 S-video; professional Y/C BNC's and 4 Composite; RCA/Phono. Outputs include 4 S-video; professional Y/C BNC's, 5 Composite; RCA/Phono and 1 XGA.
5. Includes RS-232 data port for integration with AMX system and communication port for transmission of serial data.
6. Video conferencing unit will be Polycom VS8400 with PRI interface.

C. PTZ Cameras

1. NTSC compatible with Pan/Tilt/Zoom capabilities. RS-232 serial control.
2. 10X optical zoom, 40X with digital zoom. F=3.1 to 31, F 1.8 to 2.9
3. Video output: VBS, Y/C.
4. PTZ cameras will be Sony EVI-D100.

D. Plasma Screen Monitors

1. 42" NTSC plasma monitor with 852 x 480 Pixel resolution and HDTV signal capability. Inputs include: 1 composite video, 1 S-video, 2 component video, 1 DVI video, 1 RGB and 6 audio. Outputs include: 1 audio, 1 RGB, 1 subwoofer. RS-232 control.
2. Includes universal wall mounting bracket.
3. Plasma screen monitor will be Gateway 42" Plasma TV.

2.03 SOUND REINFORCEMENT SYSTEMS

A. General

1. All equipment items shall be selected and installed to provide fully normal operation in the anticipated ambient temperature range of 55° to 100°F.
2. Any balanced audio to unbalanced audio, or unbalanced audio to balanced audio interconnections shall use a proper impedance and audio level interface such as the "Matchbox" made by Henry Engineering.

B. Power Amplifier

1. The power amplifier shall provide high and low impedance input signal capability. Amplifier shall provide output surge protection and a high-pass filter with 300 Hz cutoff for driver protection. Input power shall be 120VAC, 60Hz. Amplifier shall be rack mounted. The amplifier shall conform to the following specifications:

   a. The power amplifier shall contain a l5K ohm bridging transformer, a 15dB switchable input pad, a pre-fader unbalanced output, a post-fader unbalanced output, a master output level control, and an output transformer providing a balanced 8 ohm, 25 volt and 70.7 volt output. The amplifier shall have four input types: a 5-lug screw terminal; a female XLR; a male XLR; and a phono connector.
   b. The amplifier shall be protected from short circuit loads, over temperature, and excessive load reactance. The loads shall be protected from turn-on/turn-off transients, subsonic signals, and DC. An output relay, shall be provided to disconnect the load any of these conditions occurs. The front panel of the amplifier shall contain a "Protect" LED indicator to indicate the load has-been disconnected. The front panel shall have an LED indicator to show excessive output levels. The master level control shall be mounted on the rear panel.
   c. The amplifier shall conform to the following specifications:

      1) Input Sensitivity OdBu/15KS1 balanced line input, pad "out
      2) Power Output: 75 watts
      3) Distortion: 20Hz - < 0.1 % l kHz - < 0.01 20kHz - < 0.1 %
      4) Frequency Response +/- 1dB, 20Hz-2OkHz
      5) Input Impedance: 1-15dBu/SB-15kQ
      6) Load Impedance: 80(
      7) Noise Level: 100dB below rated output

2. The power amplifier shall be a Crown CTs 600

C. Automatic Microphone Mixer

1. The mixer shall be a self-contained, 105V-135VAC, 60Hz, mixing amplifier with preamplifiers and controls to mix four independent low-impedance automatic microphone input signals, and be expandable to eight input channels in the future
2. Each channel shall be capable of either manual or automatic level control with priority/mute circuitry for operation of each selected channel. Switchable + 48V phantom power shall be provided for condenser type microphones. All channels shall be capable of selecting balanced microphone or high level sources.

3. Each microphone input channel in the mixer shall have its own rotary gain control and channel LED to indicate the microphone is gated on. The front panel shall also contain a rotary master gain control. Each microphone input channel shall also contain a Line Out (non-gated) phone jack. The rear panel shall also contain a Main 3-pin XLR output, a 5-pin male XLR Link Output, and a 5-pin female Link Input.
4. The mixer shall conform to the following specifications:
   a. Gain: 83dB
   b. Frequency Response from 20Hz to 20kHz
   c. THD: < 0.20% from 20Hz to 20kHz at +20dBm
   d. Equivalent Input Noise: -124dBm
   e. Maximum Output Level +21dB
   f. Logic Output: 1.0VDC to 4.0 VDC
5. The mixer shall be inclosed in a metal housing designed for rack mounting. The mixer shall be a Voice-matic VM – 4043.

D. Equalizer

1. The equalizer shall contain 31 constant-Q active band-pass filters at the ISO preferred 1/3 octave center frequencies from 31.5Hz to 16kHz.
2. Each filter in the mixer shall provide up to 12dB of boost or cut at the center frequency and shall skirt with adjacent filters for minimum ripple. Boost and cut shall be controlled by linear slide controls mounted on the front panel.
3. The front panel shall contain 18dB/octave, rotary high-pass and low-pass filters with continuously variable cutoff frequency point adjustable from 20Hz to 160Hz for the high-pass filter and 5kHz to 20kHz for the low-pass filter.
4. Inputs and outputs shall be electronically balanced, the output shall be capable of driving load greater than 600 ohms. Barrier strips and XLR connectors shall be provided for input and output signal wiring.
5. The equalizer shall conform to the following specifications:

   a. Operating Gain: 0 dB
   b. Frequency Response: 20Hz to 20kHz, +0, -1dB referenced at 1kHz
   c. THD: < 0.03 % with 0 dBm output at unity gain
   d. Noise: -85dBm, A-weighted at unity gain
   e. Input Impedance: 30kQ balanced, 15k52 unbalanced
   f. Max Input Level: +24dBv
   g. Output Impedance: 4452 balanced, 2252 unbalanced
   h. Max Output Level: +24dBm

6. The equalizer shall be enclosed in a metal housing designed for rack mounting Provide security cover. The equalizer shall be a Yamaha GQ1031C.

E. Ceiling Speakers

1. Ceiling speakers shall be JBL 26CT with four primary voltage taps from 0.5 to 4 watts. Speaker includes grille, backcan, support backing bracket and tile rails, size as required.

F. Wireless Microphone System

1. Wireless microphone systems shall be Shure ULXP-14/85. Receiver shall have one XLR balanced output and one phone jack unbalanced auxiliary output. Antennas shall be mounted to provide optimum coverage.
2. Wireless microphones shall be ShureUA844. Provide standard 9V alkaline batteries for transmitter power.

G. Wire And Cable

1. Speaker wiring shall be West Penn #225.
2. Instrument cable between microphone and wireless transmitter shall be Shure WA300.

2.04 ASSISTED LISTENING SYSTEMS

A. General

1. All equipment items shall be selected and installed to provide fully normal operation in the anticipated ambient temperature range of 55° to 100°F.

B. RF Transmitters/Emitters/Receivers

1. The master RF transmitter shall operate at 72 MHz.
2. The RF transmitter shall be Listen LT 800-216. Provide wall mounting clamp for mounting transmitter and slave.
3. The IR receiver shall be a single channel portable receiver. The receiver shall be battery operated with an output of at least 10 hours. Provide two (2) receivers with rechargeable batteries and one (1) charging station for each.
4. Receiver shall be LR-400-216, rechargeable battery shall be Listen LA-361 charging station shall be a Listen LA 202.

C. Wire and Cable

1. Extension cable from the audio amplifier to the RF transmitter as required.
2. Extension cable between the RF transmitter and antennae as required.
3. Extension cable between the RF transmitter and remote mounted slave emitter as required.
4. Power distribution cable between power supply and transmitter as required. Power distribution cable between transmitter and remote mounted slave emitter as required. Provide two (2) additional DC power extension cables for each system.

2.05 REMOTE CONTROL SYSTEMS

A. General

1. The system shall be equal to AMX "AXCESS" Control System. This specification is based on the equipment manufactured by AMX Corporation of Dallas, TX 1-800-222-0193. Refer to the Manufacturer's catalog for an exact description of the equipment specified.

B. Control Panels

1. The control panels shall each consist of a table-top console with a tilt-screen touch panel display. The display panel shall tilt through an angle of approximately 60 degrees, permitting adjustment to optimize visibility and minimize glare.
2. Each control panel shall utilize a 6.6 inch by 4.9 inch high-resolution monochrome liquid crystal display (LCD). Display resolution shall be 640 by 480 pixels. Display shall use a touch-sensitive overlay.
3. The control panels shall include the following features:

    a. Microsoft or Logitech mouse compatible.
    b. System diagnostic window display full system status.
    c. Ability to upload and download panel programming, screens, and drawings.
    d. PC-based software tools provide full-featured capabilities in DOS and
    e. Windows for screen and symbol creation, symbol input, and screen printing.
    f. The control panels shall be AMX #AXT-CA10, complete with local power supply, with cord and plug for 120 volt input.

C. RF Control Panels

1. The RF control panels shall each consist of a transmitter/receiver pair communicating to the controller through the AXlink data/power bus.
2. The RF receiver front panel shall consist of 2 LED indicators, one indicator to display the status of the AXlink bus, one indicator to display the status of the RF communications. The rear panel of the receiver shall consist of one 4-pin Phoenix connector AXlink input to the receiver, one antenna TNC connector with flexible antenna, and dip switches to set the receiver device number. The receiver shall be arranged for rack mounting. The receiver shall be matched to the same frequency as the transmitter. The receiver shall be AMX AXR-RF.
3. The RF transmitter remote control of up to four functions through the receiver interface to the controller. The transmitter shall operate at 303.875MHz. The transmitter shall be AMX MX4A.

D. Integrated Controller

1. Integrated controllers shall mount in a standard 19" electronics rack. Provide cable mount brackets for cable control.
2. Each controller shall be complete with Microprocessor, Master and Control Modules and shall accommodate additional external control modules.
3. Controllers shall communicate with control panels and interface modules over the AXlink data/power bus.
4. Controllers shall be equipped with the. following:

    a. CPU - Motorola 68340, 16 bit.
    b. One RS-232/422/485 data port
    c. One RS-232/422 data port.
    d. One RS-232 data port with CTS/RTS for hardware handshaking
    e. One RS-232 TX/RX data port.
    f. One RS-232 programming port.
    g. Twelve (12) relays rated 750mA at 28VDC/VAC.
    h. Eight (8) IR/Serial ports.
    i. Six (6) I/O ports rated 200mA.
    j. Integral power supply for 120VAC input.

5. Controllers shall be equipped with status indicators as follows:

    a. Bus status
    b. Data send/receive
    c. Relay closure
    d. Position change
    e. Analog level change

6. Controllers shall be AMX #AXCENT3-PRO Cable brackets shall be AMX CSB

E. Additional Control Cardframe

1. Additional control cardframes shall be used to add-on additional control functions to the control system. Cardframes shall mount in a standard 19" electronics rack. Provide cable mount brackets for cable control.
2. Each cardframe shall be complete with a built-in card server, one master processor card slot and three control card slots.
3. The cardframes shall communicate directly with the integrated controller through the data bus and receive power from the integrated controller power supply.
4. Cardframes shall be equipped with the following control cards:

    a. Volume Control Card:

        1) Provide two channels for stereo or dual mono operation

2) Each channel shall accept either balanced or unbalanced input and provide balanced/unbalanced outputs as required.
3) Inputs: -10 to +4 dBm Maximum input output level: + l6dBm Attenuation: 0 to -72dB plus mute Volume ramp:128 steps over the range
4) The control card shall contain LED indicators for channel operation
5) The volume control card shall be AMX AXC-VOL.

b. Slide Projector Control Card:

1) The slide projector control card shall provide control of the following commands for 35mm slide converters: Forward, Reverse, Focus In, Focus Out, User Defined Contact Closure 1, and User Defined Contact Closure 2.
2) Provide a Kodak 5-pin connector between for interface to the slide converter.
3) Wire for circuits operating at 50 volts or greater shall be #12 AWG (minimum) stranded copper with insulation rating of at least 90°C for both wet and dry locations, unless otherwise indicated or required. Nominal insulation voltage shall be at least 600 volts.
4) Cable for circuits operating at less than 50 volts shall be jacketed and suitable for Class 2 wiring. Conductors shall be #22 AWG stranded copper with insulation rating of at least 90°C for both wet and dry locations, unless otherwise indicated. Nominal insulation voltage shall be at least 300 volts.

F. Spare Parts

1. Provide the Owner with a recommended spare parts list for each system, complete with pricing.

G. Manuals

1. Provide the Owner with two (2) complete sets of Operation and Maintenance Manuals (O&M) complete with As-Built shop drawings per classroom.

PART 3 - EXECUTION

3.01 INSTALLATION

A. System equipment shall not be installed until the environment is free of dust. A dust-free environment shall be considered one in which all construction work has been completed and the air handling system for the area has been operated continuously for at least two weeks with a filter change after one week. During and following installation of the system equipment, relay assemblies and equipment cabinets, the air handling system shall be kept operational continuously and shall be adjusted to maintain a positive pressure relative to building spaces outside the areas of installation. Openings into the installation spaces shall be kept closed, filters shall be changed at frequent intervals, equipment enclosures shall be kept closed, covers shall be installed and any other provisions for keeping the equipment, assemblies and cabinets clean and free of dust and deliver shall be employed.

B. Verify exact location and sizes of all existing conduit runs and back boxes prior to rough-in.

C. All switches, connectors, outlets, etc. shall be clearly, logically and permanently labeled during installation.

D. All items of equipment related to the video projection system shall be installed in the equipment cabinet provided for the purpose.

E. Provide a video ground isolation transformer in each video signal line which connects between devices which do not share a common line power distribution panel and in every case where the effect of a ground loop is apparent.

F. All wiring terminations shall be trimmed to the required length for proper system operation and neatly dressed. No excess wire loops shall remain in the final system unless required for maintenance access. Each system wire and cable shall be clearly marked at each end with the corresponding markings identified in the Operations and Maintenance manual.

G. All audio and video interconnections shall use the highest quality signal path available (Example: Use balanced audio and component video when available.)

H. Any balanced audio to unbalanced audio, or unbalanced audio to balanced audio interconnections shall use a proper impedance and audio level interface such as the "Matchbox" made by Henry Engineering.

I. Any RF interconnections (VCR/TV modulator or antenna) shall require crimped on screw on type "F" connectors and shall not use push on type "F" connectors.

3.02 WIRING

A. Wiring within equipment enclosures shall be neatly grouped or tied or run in plastic snap-cover wireway sections. All connections to panel mounted devices shall employ compression attached full 360° ring type or 'push-on' type terminators securely fastened to the device terminals. Wiring shall run behind the panel in a manner that is not visible from the operator's position. A 3" termination loop shall be formed immediately adjacent to each terminal.

B. Terminal strips shall be fully insulated but allow insertion of test equipment probes. Each terminal segment shall be numbered to correspond with the drawings and conductor identification numbers.

C. All wire and cable shall extend to each outlet location with complete electrical continuity and without any shorts or grounds. Cables shall run uninterrupted and unspliced to each remote device.

D. All wire and cable shall be in conduit, except low-voltage cables in cable trays or within 2 feet of shelf-mounted equipment. Conduits shall be grounded to the power system ground.

E. Cables shall be routed so as to maintain a separation of. At least 2 feet from all heat sources and from ballasts, transformers, dimmers and all other sources of electromagnetic interference.

F. Care shall be exercised during installation not to damage the cable insulation Damaged cables shall be removed and replaced.

G. Each cable termination shall be tagged and labeled

H. Wire color coding shall be at the option of the Contractor, but each individual conductor shall be the same color throughout its entire length.

I. For test purposes, standard operating level for sound reinforcement systems shall include that portion of the rated power range of the paging amplifiers from 10% to 100%.

J. After testing is complete, audio levels on all systems shall be set to levels satisfactory to the owner.

END OF SECTION 16710